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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/829,434
Filing Date: April 22, 2004
Appellant(s): FAIRLIE ET AL.

Edward J. Stemberger
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed November 6, 2007 appealing from the Office action mailed March 12, 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

The statement of the status of claims contained in the brief is correct.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows: The obviousness-type double patenting rejection have been withdrawn in view of the filing of acceptable terminal disclaimers.

WITHDRAWN REJECTIONS

The following grounds of rejection are not presented for review on appeal because they have been withdrawn by the examiner. The obviousness-type double patenting rejections based on US Patents 6,745,105 and 7,181,316.

(7) Claims Appendix

A substantially correct copy of appealed claims appears on pages 11-23 of the Appendix to the appellant's brief. The minor errors are as follows: claims 104-128 are not claims on appeal having been withdrawn from consideration.

(8) Evidence Relied Upon

5,592,028	Pritchard	1-1997
4,084,038	Scragg et al. (Scragg)	4-1978
4,388,533	Campbell et al. (Campbell)	6-1983
6,021,402	Takriti	2-2000

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 25-27, 29-31, 36, 38-43, 45-61, 63-64, 66 and 82-103 are rejected under 35 U.S.C. 103(a) as obvious over Pritchard (US 5,592,028) in view of Scragg (US 4,084,038), Campbell (US 4,388,533) and Takriti (US 6,021,402). In the patent Pritchard teaches a wind farm generation scheme utilizing electrolysis to create gaseous fuel for a constant output generator. In the device at least some of the power output from the wind farm is utilized to convert water into hydrogen, store and burn the hydrogen to produce energy, and use the energy from the burning for the generation of electricity. The means includes a plurality of electrolysis modules (hydrogen generators) consisting of electrolytic cells connected in series, with at least two modules connected in parallel by a switch means. Figure 1 shows a wind farm (1, renewable source of electric energy) which provides electrical power via a switch/transformer (2) to either the public utility grid (3) or an AC-DC converter/filter (4). By the fact that there are two possible paths for the electricity produced by the wind farm, a controller of the switch/transformer is required. Any resultant DC output of the wind farm after being suitably filtered by the AC-DC converter/filter, is fed to an electrolysis plant (5) where water is split into hydrogen and oxygen by the electrolysis modules. The hydrogen produced is sent through a pipe to a compressor (6) then into a purification plant (7) and then into hydrogen storage means (8). After passing into the hydrogen storage means, the hydrogen may pass from the storage means to a hydrogen combustion/electrical generation plant (20). Alternatively, the hydrogen may pass from the storage means through a purification/liquefaction plant (9) into long term storage means (10). Again since there are multiple possibilities a controller is required to determine what happens to the hydrogen that is produced (storage to user or long term storage). The storage means should have sufficient capacity to accommodate short term variations in available wind

energy (of the order of a few weeks). The long term storage means (10) should have sufficient capacity to accommodate seasonal variations. Outlet means (11) provide for delivery of liquid hydrogen. Outlet means at 12 provide for delivery of gaseous hydrogen. The electrical generation plant may incorporate means for burning hydrogen in air or stoichiometrically with oxygen. Various means of combustion may be employed. Non-limitative examples include a conventional steam boiler/steam turbine plant (21), direct generation of steam from the stoichiometric combustion of hydrogen with oxygen (22), an internal combustion engine (23), hydrogen gas turbine combustion (24) or a hydrogen fuel cell (25). All the means (21-25) would effect the turning of conventional electrical generating plant which would output electrical power to the grid. Figure 2 shows the electrolysis plant in more detail. The plant includes a number of voltage dependent switches (32) each connected to an electrolysis module (38) (a stack of electrolysis cells 35a, 35b . . . 35z connected in series). DC (+) current from the wind farm, smoothed by the filter is passed to a voltage dependent switch. The switch has a number of operating positions (34) and the switch includes control means arranged to cause it to adopt a particular position dependent on the voltage across it. The switch can be electro-mechanical or electronic such as a thyristor. In this case each cell of the module would be connected via a thyristor to the voltage supplied with only one thyristor open at a time to determine the number of cells operating, viz if the thyristor connected to the sixth cell is open the voltage is supplied to the first six cells. The electrolysis cells have an optimum operating voltage at which they operate with maximum efficiency. Depending on cell construction this optimum operating voltage is normally between 1.5 and 2.0 volts at room temperature. The voltage switch is arranged to ensure that each cell receives the correct voltage across it to ensure maximum efficiency by energizing the correct number of cells. For example if the voltage measured between the input and ground is 16 volts and the electrolysis cells have an optimum operating voltage of 1.6 volts then the switch is arranged to automatically move to a position where the 16 volts is supplied across 10 electrolysis cells. Each of the 10 cells then has a voltage of 1.6 volts across it: if the measured voltage changed to 19 volts then the switch would move to energize a further two cells making a total of 12 energized cells, each of which would have a voltage of 1.58 volts (close to the optimum) across it. In the preferred embodiment, the transition between

switch positions is done so as to avoid losses due to spike effects and the switch response time is matched to the temporal (real time) characteristics of the filter. Although not indicated in the figure, a means may be provided to monitor the current density through each module and thereby provide feedback to the switch control means (the control means is connected to the electricity generator and collects data that is used by the controller to control the switches). Column 4, lines 36-49 teach that the invention allows for much longer periodic smoothing of the wind energy availability curve. The result of this is to allow a more reliable design for wind farms based upon seasonal or annual mean wind speed figures (at least related to the availability of power). The invention will permit, in principle, wind energy to contribute up to a 100% of total grid power, limited only by the total energy available in the local wind regime. All electrolysis products are initially put into the various storage means, and the electrolysis plant is made capable of accepting any power input up to the maximum rated, power of the wind plant. This can greatly simplify the design of the wind energy conversion plant as complex electro/mechanical output control is unnecessary. The wind farm could be designed to produce DC, and therefore hydrogen, at all times and may never have a direct connection to the grid. Column 2, lines 37-38 teach that preferably the system includes control means to monitor (collect data) and control the system. From the rest of the summary of the invention it is clear that the system includes the wind farm, the hydrogen generator the hydrogen storage means and the means to convert the hydrogen into electrical energy. As such the control means would have inherently been connected to the wind farm energy source to collect data as a part of its being able to monitor and control the system since using the hydrogen to generate electricity to put into the grid when the power from the wind farm is not sufficient to meet the needs/demand of the grid is part of the intended purpose of reducing the power variation form the wind farm power source. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the control means to monitor the electricity from the wind farm to be able to control the electrical generation plant when the power needs are not being met by the wind farm. Relative to the elements of claim 25, Pritchard teaches at least one hydrogen generator (water electrolysis plant 5) for generating hydrogen using electricity from at least one source of energy (wind farm 1), at least one storage reservoir (hydrogen storage means 8 and

long term storage means 10) and at least one control means to monitor and control the system (column 2, lines 37-38 which is different from the means to monitor the electrolysis cells found in column 2, lines 22-24). That there is a system controller can clearly be inferred from the following facts: the electricity produced from the wind farm can go either to the power grid 3 or through a converter 4 to the electrolysis plant 5 (column 2 lines 57-62; the hydrogen in storage means 8 can either be used for electrical generation or sent to long term storage (column 3, lines 1-6); the storage means are taught as having capacity for varying periods of time (column 3, lines 12-16) and the fact that the production of hydrogen is intended to smooth the wind energy availability curve (column 4, lines 34-46, indicating the ability to control the production of electricity to supplement the electricity from the wind farm). Relative to claim 39, Pritchard clearly teaches a compressor (6) between the hydrogen generator and the hydrogen storage means. Pritchard does not teach a more involved computer based control system or the factors/variation in conditions that would have controlled the production and storage of hydrogen in the system.

In the patent Scragg teaches an electrical power generation and storage system. Columns 1-2 teach that in the process of generating electric power by conventional power generating systems, e.g., hydro-electric, steam turbine, gas turbine, diesel, or gas engine systems, each system, if operated at a constant power level, operates inefficiently during periods because of variable load factors typically encountered. For example, the load factor may vary, in a typical household, from 100 watts per hour between midnight and 5:00 A.M. to 25,000 watts per hour between 6:00 A.M. to 9:00 A.M. and 3:00 P.M. to 7:00 P.M. The load factor in a commercial office building may vary from 10,000 watts per hour between 6:00 P.M. to 8:00 A.M. and increase to 100,000 watts per hour between 8:00 A.M. to 6:00 P.M. As is known in the art varying conditions cause load factors which vary not only on a daily basis but also on a seasonal basis. In the case of the typical household, it would require a 25,000 watt generator running 24 hours a day to produce the necessary power to meet the relatively short duration peak loads as well as minimum loads which typically exist for a longer period of time, thus producing a total of 600,000 watts in 24 hours. However, the typical household utilizes less than a total of 200,000 watts in this 24 hour period. Due to these varying load factors, all sources of power

generation, whether large megawatt generators or smaller on site generators, have periods in which the demand is for the total generating capacity followed by periods of surplus generating capacity. If the surplus energy could be efficiently stored, the peak power generating capacity and/or spinning capacity could be reduced thereby reducing the capital equipment and fuel required to generate a given amount of electricity. In the alternative, the power generating equipment used to meet peak demand would operate only during the relatively short peak demand intervals with the excess power generated being stored, then utilized during other non-peak demand intervals. Fuel cells of several types and hydrogen-oxygen batteries have been developed which are utilized in the conversion of gases to generate direct current electricity with efficiencies which range from 60% up to as high as 98%. Further, hydrogen reform process plants have been developed which are utilized to produce high purity hydrogen at efficiencies of 40% when fired directly by fuel gas, and can produce high purity hydrogen at greater efficiencies with external steam supply. Accordingly, the invention relates to a process for generating and temporarily storing generated electrical energy during periods of less than peak demand in the form of electro-chemical chemical and electro-mechanical mediums. As the demand for electrical energy increases, the stored energy is reconverted back to AC electrical energy for utilization by consumers.

In the patent Campbell teaches a power generation system for supplying electrical power to an external power demand load. Figure 11 is a schematic view illustrating the overall control of the system. From the figure and its associated description beginning on column 11, line 38, the output from the electrical power generator unit (12) is connected to a power distribution network (130) which selectively connects the output of unit 12 to the external power demand load, the internal system demand load and the fuel generator (90). The fuel generator is an electrolysis unit. The distribution network has a built-in inverter so that direct current can be supplied to the fuel generator and alternating current can be supplied to the external power demand load. The network monitors the output of the generator unit and the external power demand load. When the output of generator unit exceeds the external power demand load and the internal system demand load, the network supplies enough of the output of the generator unit to satisfy these demand loads and routes the remaining output to the fuel generator to generate

hydrogen for storage. The fuel generator is controlled by a fuel control circuit (131) connected to water level sensor (132), the water inlet valve (96), and the pumps (104 and 108) of the electrolysis unit. As power is supplied to the fuel generator from the power distribution network, oxygen and hydrogen gas will evolve and the water level in the electrolysis unit will be lowered. When the water level has been lowered a prescribed amount, the water level sensor will be tripped. This causes the fuel control circuit to open the water inlet valve to raise the water level in the electrolysis unit while at the same time causing pump 104 to pump the generated hydrogen gas to storage tanks (91) through the distribution valve assembly (105) and pump 108 to pump the generated oxygen out. When the water level has been raised back to the desired level, sensor 132 is operated to cause fuel control circuit to close the water inlet valve and stop pumps 104 and 108. The overall operation of the system is controlled from a microprocessor (computer) MPU connected to the power distribution network, the fuel control circuit, the distribution valve assembly, the horizontal sun tracking control circuit and the vertical sun tracking control circuit. The microprocessor MPU is also connected to a sunlight monitor (134), a wind monitor (135), and a fuel level monitor (136). The microprocessor is programmed so that when the solar isolation detected by sunlight monitor is below a predetermined threshold level, the microprocessor MPU will disable the sun tracking control circuits. If the fuel level monitor indicates hydrogen is available from storage tanks (91), then the microprocessor MPU operates the distribution valve assembly so that the hydrogen from the tanks is supplied to a burner assembly (56) for burning in air to heat the air and operate the power generator unit 12. The microprocessor MPU monitors the output of the generator unit, the internal system demand load and the external power demand load and controls distribution the valve assembly so that just enough hydrogen is supplied to the burner assembly to operate the generator unit so that its output equals the internal system demand load and the external power demand load. A similar use of hydrogen occurs when there in not enough solar energy to run the generator unit at a level which satisfies the internal system demand load and the external power demand load. As soon as the level of solar isolation detected by the sunlight monitor is sufficient to operate the generator unit at a level which at least satisfies the internal system demand load and the external system demand load, the microprocessor MPU operates the distribution valve assembly to connect the

outlet pipe from the fuel generator to the storage tanks and cut off the fuel supplied to burner assembly. The fuel control circuit is enabled so that hydrogen will be generated and stored using the excess output of the power generator unit.

In the patent Takriti teaches a computer implemented risk-management system for scheduling the generating units of an electric utility while taking into consideration power trading with other utilities and the stochastic load on the utility system. The system provides the user with a tool that generates multiple load forecasts and allows the user to vary the fuel price between the different scenarios and the different periods of the planning horizon. The tool allows the user to model accurately the uncertain trading transactions and the changing fuel prices to meet the electric demand of customers at a minimal cost while making the maximum profit possible from power trading. The tool also allows the user to apply any set of linear constraints to fuels. A mathematical model of the problem is solved to provide the status of each generator at each time period of the planning horizon under each given scenario, the load on each generator during each period in which it is operating, an optimal fuel mix for each generating unit, and the prices for purchasing and selling power in the periods of the planning horizon. In the background given in columns 1-4, Takriti discusses the different types of electrical generating devices including boilers using steam to turn a turbine and quick start generators using fuel heating of air to turn the turbine and produce electricity. This section also discusses the difference in cost and operating efficiency of these types of electricity producers. Both the boiler and quick start types of electricity generators are found in the hydrogen combustion/electricity generation plant of Pritchard.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate a computer/microprocessor based control system as taught by Campbell in the Pritchard system because of the ability to both monitor and control the various aspects of power generation and hydrogen production and use based on demand and the variations in the demand and the ability of the power generator unit to produce power during daily and long term seasonal cycles as shown by Campbell, Scragg and Pritchard. It further would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate a control/risk management system as taught by Takriti into the Pritchard device /system because of the ability

or predict the need for various inputs such as the daily cycles of Scragg or the seasonal variations of Pritchard in combination with their cost, thereby reducing the cost/risk of operating the system as taught by Takriti since the Pritchard system included components for electricity generation that are included and controlled by the system of Takriti.

(10) Response to Argument

Relative to the control taught by the Pritchard reference, examiner's position is that there is a general control for the system taught by Pritchard. This is based on the following facts and interpretations of the disclosure. First column 2, lines 22-24 teach a specific type of control/monitor for the electrolysis cells. This is the switching system shown and described in figure 2. Column 2, lines 37-38 teach that preferably" the system includes control means to monitor and control the system." When the disclosure of column 1, line 60 to column 2 line 3 is looked at, it is clear that "the system" refers to the wind farm in combination with the electrolysis cells, the hydrogen storage means, the hydrogen combustion means and the means to utilize some of the energy produced for the combustion of hydrogen to electricity. in other words the system control means is clearly taught as monitoring and controlling the whole system, not just one part of the system. In this context, the switch/transformer (2) shows that there is a control means to monitor the power from the wind farm and provide it to one or the other of the public grid or the AC-DC converter/filter. Likewise, the alternative paths – storage means (8), long term storage means (10) and hydrogen combustion/electrical generation plant (20) – show that a controller must have been present to direct the hydrogen along one of the alternate paths. From the fact that there is no direct connection between the long term storage means (10) and the hydrogen combustion/electrical generation plant (20) one can infer that there is some form of controller to control the flow between the hydrogen storage means (8) and the long term storage means (10). Finally, column 4, lines 34-46 show that a controller for the system must exist so that the smoothing of the power from the wind farm can occur. Thus contrary to appellants argument, Pritchard does have a system controller, not just the switch controller of figure 2.

What Pritchard does not teach are the specifics of the controller (microprocessor based or otherwise) and on what basis is the system monitored and/or controlled. In this respect the cited Campbell reference clearly shows that microprocessor based control is known and was used to

both monitor and control a power generating system that includes means to generate and store hydrogen as part of the power generating system. Additionally, each of Pritchard, Scragg and Campbell show that it is known that there are different demands for the production of electricity and the need to supplement the electricity produced by utilizing stored hydrogen on time frames as short as hours and as long as seasons or months. Thus there is a clear indication that it would have been obvious to one of ordinary skill in the art to at least incorporate a microprocessor/computer into the system monitor/controller of Pritchard and the ability to control the system to produce or use hydrogen based on the variability of its demand and the ability of the wind farm to meet the demand for electricity supplied to the public grid. The switches of Pritchard are present to control the number of electrolysis cells in use to produce hydrogen so that each electrolysis cell is operating in its optimum voltage range, not to control the whole system.

The Takriti reference shows that in generation of electricity, there are various risk/cost factors that need to be taken into account in the control and operation of system. Since Pritchard is an electrical energy generation system, one of ordinary skill in the art would have recognized that Pritchard and Takriti are analogous art and have implemented the teachings of Takriti in the operation of the Pritchard system to control the cost or risk or operating the system. That there would have been cost or risk factors in the Pritchard system can be seen from the fact that the wind farm may be able to contribute up to 100% of the total grid power (column 4, lines 34-46). However, if it does not contribute the total power need, the additional power must come from other sources and the Takriti system would have been recognized as being obvious to incorporate into the controller of the system of Pritchard for its ability or handle such a combined system.

Relative to the statement about claim 36, "the amount of energy available" and others of the list are met by the seasonal or annual wind speed figures found in column 4, lines 34-37. Further the risk/cost teachings of Takriti would have pointed to the obviousness of other possibilities and/or combinations of possibilities in the group.

Relative to the statement about claim 39, inherent in the fact that there is a compressor (6) between the hydrogen generation means and the hydrogen storage means is the fact that it is

functioning to compress the hydrogen to some desired pressure. Since the claim does not specify a specific desired pressure, any compression of the gas meets this limitation.

Relative to the statements about claims 40-41, examiner points our that since the only connection between the long term storage means (10) and the hydrogen combustion/electrical generation plant (20) of Pritchard goes through hydrogen storage means (8), the system controller of Pritchard must include some sort of monitor to both determine that there is excess hydrogen that needs to be transferred to the long term storage means and that hydrogen needs to be transferred from the long term storage back to the hydrogen storage means. This control would have included at least some minimum threshold to insure that the amount of hydrogen stored in the hydrogen storage means could meet the capacity for short term variations taught by column 3, lines 12-14.

Relative to the statement about claim 43, examiner notes that a microprocessor as taught by Campbell which is programmed to perform various functions usually has some form of operator interface such as a keyboard so that it can be programmed.

Relative to the statement about claim 45, each of Pritchard, Campbell and Scragg show that the demand for electricity and the ability to produce electricity from one or more sources varies. This variation can be on the timescale of hours, weeks or months. Additionally, Takriti teaches that various parts of the production of electricity should be forecast or predicted to manage costs.

Thus each of these claims is met by teachings from the Pritchard reference or the Pritchard reference in combination with one of Campbell, Scragg or Takriti.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Arlen Soderquist

Arlen Soderquist
Primary Examiner
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Conferees:

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